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Test-retest of self-reported exposure to artificial tanning devices, self-tanning creams, and sun sensitivity showed consistency

Laura E. Beane Freeman[a,b,*], Leslie K. Dennis[b], Charles F. Lynch[b], John B. Lowe[c], William R. Clarke[d]

[a]*Division of Cancer Epidemiology and Genetics, National Cancer Institute, Occupational and Environmental Epidemiology Branch, 6120, Executive Boulevard, Suite 511, MSC 7240, Bethesda, MD 20892-7344, USA*

[b]*Department of Epidemiology, College of Public Health University of Iowa, Iowa City, IA, 52242*

[c]*Department of Community and Behavioral Health, College of Public Health University of Iowa, Iowa City, IA 52242*

[d]*Department of Biostatistics, College of Public Health University of Iowa, Iowa City, IA 52242*

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Abstract

Objective: Exposure to ultraviolet radiation has consistently been linked to an increased risk of melanoma. Epidemiologic studies are susceptible to measurement error, which can distort the magnitude of observed effects. Although the reliability of self-report of many sun exposure factors has been previously described in several studies, self-report of use of artificial tanning devices and self-tanning creams has been less well characterized.

Study Design and Methods: A mailed survey was re-administered 2–4 weeks after completion of the initial survey to 76 randomly selected participants in a case-control study of melanoma. Cases and controls were individuals diagnosed in 1999 and 2000 who were ascertained from the Iowa Cancer Registry in 2002. We assessed the consistency of self-reported use of sunlamps and self-tanning creams, sun sensitivity, and history of sunburns.

Results: There was substantial reliability in reporting the use of sunlamps or self-tanning creams (cases: Kappa (κ) = 1.0 for both exposures; controls: κ = 0.71 and 0.87, respectively). κ estimates of 0.62–0.78 were found for overall reliability of several sun sensitivity factors.

Conclusion: Overall, the survey instrument demonstrated substantial reproducibility for factors related to the use of sunlamps or tanning beds, self-tanning creams, and sun sensitivity factors.

Keywords: Reliability; Melanoma; Case-control study; Sunburn; Sunlamp

1. Introduction

Exposure to ultraviolet radiation (UVR) has been linked to an increased risk of melanoma [1,2]. Artificial tanning devices, such as sunlamps and tanning beds, have become increasingly popular in recent years and are another common source for UVR exposure [3]. Self-tanning creams, or sunless tanning lotions, first appeared in the 1950s [4]. Their potential association with melanoma has not been studied in depth. Most studies of melanoma have relied on retrospective self-report of exposures. Such reporting is susceptible to misclassification or measurement error, which can bias observed results.

The purpose of this reliability study was to ascertain the consistency of self-reported use of self-tanning creams and sunlamps and factors related to sun sensitivity and history of sunburns in a study population consisting of cases with cutaneous melanoma and controls with colorectal cancer.

2. Methods

2.1. Subjects

The reliability survey was re-administered to a subsample of the study population 2–4 weeks after completion of the initial survey. Participants in the initial survey included 369 melanoma cases and 375 colorectal cancer controls, frequency-matched on gender and 5-year age category. All participants were Iowa residents at time of diagnosis, white, age 40 or older, and diagnosed with malignant cancer in 1999 or 2000. Respondents completed a 14-page mailed survey with questions about use of sunlamps and self-tanning

* Corresponding author. Tel.: 301-451-8793; fax: 301-402-1819.
E-mail address: freemala@mail.nih.gov (L. Freeman).

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creams and about sensitivity to the sun. For the reliability study, 106 participants were randomly selected to participate. Seventy-six participants (45 cases, 31 controls) completed the survey (71.6% response rate). The consent form explained that a random sample of subjects would be re-contacted. The University of Iowa's Institutional Review Board approved this recruitment protocol and all study materials.

2.2. Exposure measures

Sun sensitivity questions asked were validated and used in prior studies in Australia [5] (A. Girgis, University of Newcastle, personal communication, 2001). Questions on artificial tanning were designed after questions used in the same studies [5] (A. Girgis, University of Newcastle, personal communication, 2001). Using a similar structure, we developed questions about use of self-tanning creams. The questions selected were reviewed by three researchers with experience in the field of surveys and melanoma for face validity.

2.3. Statistical methods

Test-retest or intra-method reliability was examined through re-administration of the same instrument to a random sample of subjects. Cohen's kappa (κ) was used to determine reliability for categorical variables. Weighted κ was used for ordered categories to give "partial credit" for small error versus large error using Cicchetti-Allison weights [6].

Table 1
Demographic characteristics of reliability study participants compared with overall study participants in Iowa, 1999–2000

	Reliability participants (n = 76)	Overall participants (n = 741)
Case/control status		
Case	45 (59.2)	368 (49.7)
Control	31 (40.8)	373 (50.3)
		χ^2 P = .1129
Gender		
Male	45 (59.2)	446 (60.2)
Female	31 (40.8)	295 (39.8)
		χ^2 P = .8683
Age (y)		
40–49	12 (15.8)	155 (20.9)
50–59	20 (26.3)	195 (26.3)
60–69	14 (18.4)	191 (25.8)
70–79	22 (29.0)	140 (18.9)
80+	8 (10.5)	60 (8.1)
		χ^2 P = .1728
Education[a]		
Less than high school	11 (14.5)	73 (10.0)
High school	22 (29.0)	280 (38.3)
More than high school	43 (56.6)	378 (51.7)
		χ^2 P = .1964
Marital status		
Married	59 (77.6)	581 (78.4)
Never married	6 (7.9)	35 (4.7)
Divorced/separated	5 (6.6)	45 (6.1)
Widowed	6 (7.9)	80 (10.8)
		χ^2 P = .5793

[a] Numbers do not sum to total because of missing information.

3. Results

3.1. Comparability of reliability study and overall study participants

Participants in the reliability study were similar to participants in the overall study regarding gender, age, educational history, and marital status (Table 1), suggesting that reliability subjects were representative of the overall study participants. Reliability study participants were marginally (P = .11) more likely to be cases than were participants in the study as a whole.

3.2. Reliability of instrument

The reliability of the survey instrument was substantial [7], with most κ coefficients above 0.60. All reliability coefficients were significantly different from zero.

The reliability of questions on "ever" use of sunlamps, self-tanning creams, and sunscreen showed that melanoma cases were somewhat more consistent in their recall of exposures (Table 2). However, only 10 reliability study participants had ever used a sunlamp, and only 11 had ever used self-tanning creams, making it challenging to evaluate reliability for more detailed questions with four or five possible answers. Therefore, reliability coefficients were not calculated for "time since first use," "time since last use," "frequency of use," "alteration of sun exposure patterns due to their use of sunlamps," or "alteration of sun exposure patterns due to their use of self-tanning creams."

Reliability coefficients of factors associated with sun sensitivity are shown in Table 2. When considering reliability of cases and controls together, the reliability coefficients range from 0.62–0.78. Melanoma cases had reliability coefficients ranging from 0.58–0.81, and reliability coefficients for controls ranged from 0.63–0.79.

4. Conclusion

Overall, subjects seemed to consistently recall past exposures to potential melanoma risk factors. Reliability for use of sunlamps and self-tanning creams was almost perfect, indicating that participants were able to consistently report whether they had ever used these products. Only one prior study [8] reported on reliability of use of artificial tanning devices and found κ = 0.73, similar to our κ = 0.83. To our knowledge, no other studies have reported on the reliability of self-tanning cream use. We found self-report of self-tanning cream use to be more reliable than self-report of artificial tanning device use.

Table 2
Reliability coefficients for factors related to sun sensitivity and history of sunburn for melanoma and colorectal cancer controls in Iowa, 1999–2000[a]

Factor	Overall reliability coefficient and 95% CI ($n = 76$)	Reliability coefficient and 95% CI: melanoma cases ($n = 45$)	Reliability coefficient and 95% CI: colorectal controls ($n = 31$)
Sunlamp use[b]	0.83 (0.65–1.0)	1.0	0.71 (0.40–1.0)
Self-tanning cream use[b]	0.94 (0.84–1.0)	1.0	0.87 (0.62–1.0)
Current sunscreen use[c]	0.77 (0.68–0.87)	0.81 (0.69–0.93)	0.68 (0.50–0.86)
SPF of sunscreen[d]	0.59 (0.41–0.78)	0.60 (0.36–0.84)	0.56 (0.27–0.85)
Sun sensitivity			
Tendency to burn[e]	0.62 (0.45–0.78)	0.59 (0.37–0.81)	0.66 (0.41–0.90)
Ability to tan[f]	0.66 (0.53–0.80)	0.58 (0.38–0.78)	0.76 (0.58–0.95)
Untanned skin color	0.78 (0.60–0.93)	0.81 (0.61–1.0)	0.74 (0.44–0.97)
Skin type[g]	0.71 (0.56–0.86)	0.66 (0.46–0.86)	0.79 (0.59–0.99)
Sunburns before age 14[h]	0.73 (0.61–0.86)	0.77 (0.62–0.92)	0.68 (0.48–0.88)
Sunburns ages 14–18[h]	0.67 (0.54–0.80)	0.67 (0.51–0.83)	0.67 (0.45–0.88)
Sunburns after age 18[h]	0.69 (0.55–0.83)	0.73 (0.59–0.95)	0.63 (0.38–0.89)
Prior skin cancer diagnosis	0.78 (0.62–0.95)	0.76 (0.56–0.95)	0.78 (0.38–1.0)

[a] All coefficients were significantly different from 0 at $P < .001$.
[b] Ever versus never use.
[c] Frequency of use when outside on a sunny day (always, more than half the occasions, less than half the occasions, never).
[d] SPF usually used on a sunny day in the summer (<SPF 15, SPF15, >SPF 15, don't use sunscreens when outside).
[e] Tendency to burn defined as "skin reaction to sunlight after an hour for first time each summer" (severe and painful sunburn, mild sunburn, no sunburn).
[f] Ability to tan defined as "skin's reaction to repeated and prolonged exposure to the sun" (deeply tanned, moderately tanned, mildly tanned, have no tan).
[g] Skin type defined as skin's reaction when "exposed to strong sunlight for 30 minutes for the first time each summer with no protection" (burn, then blister; just burn, not tan; burn first, then tan; not burn at all).
[h] Number of sunburns so severe to produce blisters or pain lasting 2 days or longer (none, 1–2, 3–5, 6+, don't know).

For sun sensitivity factors and history of sunburn, our survey instrument was reliable with a magnitude comparable to other instruments measuring similar exposure measures [8–10], which likely reflects our use of questions developed from previously tested sun exposure questions.

Reliability of potential confounders, such as sun sensitivity and history of sunburns, was substantial, ranging from $\kappa = 0.62$ for tendency to burn to $\kappa = 0.78$ for skin color and prior skin cancer diagnosis.

In summary, the overall reliability of this study suggests that the observed associations may be regarded with some confidence. For self-tanning cream use, it is unlikely that nondifferential misclassification skewed the results. For use of sunlamps, it is possible that misclassification may have underestimated this effect. There was little evidence that recall bias significantly skewed our results. However, the possibility cannot be completely discounted because we did not measure exposures before and after diagnosis.

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